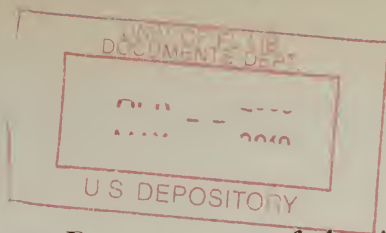


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ANALYSES OF CANNED PEAS AND BEANS, SHOWING COMPOSITION OF DIFFERENT GRADES.

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INTRODUCTION.

In the usual commercial canning processes the green peas are separated from the pods, put through a cleaner, and then graded into several sizes. They are next passed through a bath of hot water, for the purpose of blanching, and are then filled into the cans, which already contain some liquor consisting of a simple brine, to which a certain amount of sugar is sometimes added. The cans are capped and soldered and processed in a steam kettle for a period of about thirty minutes. The product of this procedure is the ordinary canned pea familiar to everyone.

Another kind of peas found on the market is prepared from dried green or Scotch peas grown in Michigan and Wisconsin. These peas are received by the packer in a dry condition and are first soaked in large tanks for a period varying from twelve to thirty-six hours, depending upon the season of the year and the temperature. This soaking process is usually so conducted as to carry off any foreign material that may be present, thus serving the double purpose of softening and cleaning the peas. After being sufficiently soaked, they are blanched and canned, and processed in a manner similar to that employed for the fresh peas.

Soaked peas are occasionally found on the market bearing various fancy labels and are sometimes presented to the customer as fresh peas. This investigation was made primarily to obtain data regarding the composition of fresh and soaked peas with a view to distinguishing between the two classes of goods. Incidentally, some determinations were made on green peas before being processed in order to determine, if possible, what changes take place during canning. As will be seen from the results, however, the figures obtained are not

of much value for this purpose, the whole study merely serving to furnish analytical data for the purpose of comparing commercial grades.

SAMPLING.

Samples of two varieties of fresh peas were taken by the writer at two factories near at hand. A sample of each size, after passing through the grader, was secured and the analysis begun the same day. Corresponding samples of the peas after being processed were also obtained so as to make as complete a comparison as possible. In addition to these samples, taken under direct supervision, the writer obtained quite a number from other factories, some of which were stated to have been soaked. A few samples were submitted without any statement of quality, the analysis of which seemed to indicate soaking. This point will be discussed in connection with the data.

The canned peas were first drained in a colander for two minutes, stirring thoroughly so as to remove as much as possible of the adhering liquid. After determining the specific gravity, the peas were ground and further determinations made.

METHODS OF EXAMINATION.

Specific gravity.—Drop 20 sound peas, taken at random, into salt solutions of various strengths and record the number floating and sinking. By the use of solutions ranging in specific gravity from 1.05 to 1.15 the specific gravity of the sample may be approximated.

Moisture.—Dry a weighed portion of the ground sample for twelve hours at the temperature of boiling water.

Ash.—Ash the residue from the moisture determination at low redness.

Crude starch.—Transfer 15 grams of the sample to a 500 cc Erlenmeyer flask with 200 cc of water; add 20 cc of hydrochloric acid (specific gravity 1.125) and heat the solution to boiling for two and one-half hours with a reflux condenser. After nearly neutralizing the acid with sodium hydroxid, transfer the solution to a 300 cc flask, add 5 cc of basic lead acetate, and complete the volume to the mark. Filter and remove the lead from a portion of the filtrate with a dry mixture of potassium sulphate and potassium carbonate. In the filtrate obtained from this treatment determine reducing sugar, using Munson and Walker's tables,^a and multiplying dextrose by 0.9 to obtain starch.

Nitrogen.—Determine nitrogen in 10 grams of sample by the Gunning method.

Ether extract.—Extract the residue from the water determination for sixteen hours with ether.

^a U. S. Dept. Agr., Bureau of Chemistry Bul. 107, Revised, p. 243.

Crude fiber.—Treat 20 grams of the sample according to the official method,^a except that about 100 cc of hot water are added after each period of boiling and before filtering. This addition of water seems to make the filtration much more rapid and serves to obviate the plugging of the pores by the material, which occurs when the more concentrated solution is filtered. Filter the residue and weigh on paper.

DISCUSSION OF RESULTS.

The distinction between soaked and fresh peas is, of course, made with some degree of certainty by the simple examination of the physical appearance of the goods, noting especially the maturity and firmness of the peas and the character of the liquor. Soaked peas are usually more or less broken and mashed, while the most matured show well-developed cotyledons and are packed in a liquor which is cloudy and starchy in appearance. It is seldom that the liquor in which soaked peas are put up is in the clear and limpid condition of that found on the fresh goods. The maturity of the peas can not be taken as conclusive evidence that the same have been soaked, however, because some of the oldest and best developed peas packed in the fresh state are very similar in appearance to the varieties which are soaked before canning. Neither can the appearance of the liquor be finally relied upon, since the matured fresh peas are sometimes found packed in a liquor which is not clear and is more or less starchy. Hence it seemed desirable to obtain some chemical data which would serve to confirm and substantiate conclusions drawn from the physical appearance of the goods under examination.

The table of analyses given sets forth the results of physical and chemical examinations of the samples of peas, both fresh and canned (the latter including a number of samples of soaked peas). From this table it will be seen that it is not hard to distinguish the fresh and more succulent grades from the soaked material, the chief difficulty arising in differentiating between the soaked goods and the more matured peas put up in the usual way. As to water content the latter do not differ very widely from the soaked peas. As will be seen from the table, the average moisture content for 22 samples of soaked peas is 72.02 per cent, and the average for 21 samples of mature fresh peas is 76.54 per cent. The soaked peas containing the highest percentage of moisture, 74.92 per cent, exceed in that particular the driest of the unsoaked, 70.79 per cent, so that there is an overlapping of the results which makes it impossible to base a conclusive opinion on this determination alone.

^a U. S. Dept. Agr., Bureau of Chemistry Bul. 107, Revised, p. 56.

The lines may be drawn a little closer by also estimating the crude starch. The average of 21 results on soaked peas gave 13.98 per cent, the highest figure being 18.19 per cent and the lowest 11.08 per cent, while the average starch content of 21 samples of matured peas canned in the fresh state was 11.05 per cent. Here again there is an overlapping which renders the conclusion a little uncertain. The average starch content, however, of soaked peas, as indicated by this investigation, is approximately 4 per cent higher than that of Early Junes and peas of similar quality. There is, furthermore, some difference in the specific gravity of the two grades, that of the fresh peas running from 1.10 to 1.14, whereas the figure obtained for soaked peas varied from 1.12 to 1.16.

It would therefore seem that the determinations enumerated afford results which may serve to substantiate to a great degree conclusions drawn from physical examinations of such canned goods. A few examples taken from the table are of interest: Samples Nos. 96 and 97 were labeled "Early June Peas," but both have the appearance of having been soaked, the peas being large, well-developed, mealy, and packed in a liquor which is very cloudy, thick, and starchy in appearance. Comparing the results obtained on these samples with the figures for Nos. 80 to 94, inclusive, which were labeled the same way, it will be seen that the starch content is decidedly higher in the case of the former samples. By this determination alone and the appearance of the goods it would be quite safe to conclude that the peas had been soaked, but there is also a difference in the specific gravity, which is somewhat higher in these samples than in the others. The conclusion is further strengthened by the amount of water found, which is less in the case of the suspected peas than in those apparently true to label. Examples like this might be multiplied, but these will serve as an illustration.

Only 11 samples of Lima beans were examined, 4 of which were stated by the manufacturer to have been prepared from dried California Limas after being soaked in the same way as the peas. The limited data obtained indicate that their water content when canned in the fresh state is higher than when they are prepared from soaked beans. The crude fiber and crude starch in the latter are higher than in fresh beans. Calculated to the dry basis these differences between the two grades of beans are not so pronounced, so that the variation seems to be largely one of water content. The soaked beans have a higher specific gravity, although the difference is not sufficient to make the determination one of much value in judging the product. With this vegetable, as with peas, great reliance must be placed on the physical appearance of the goods. The California Lima beans are very large and those used for the preparation

of soaked goods are firm and mature. An attempt was made to obtain data which would indicate the swelling of the beans during the soaking process, the ratio between the length, width, and thickness being determined on all of the samples. It was found, however, that this ratio was practically the same for all grades of canned Lima beans examined, so that while some of the soaked beans appeared to have swelled materially the relative thickness was no greater. Here again the comparison is not conclusive, because, while different varieties of beans were subjected to the test, no results were obtained on a single variety canned in both the fresh and dried state.

In regard to the analysis of peas before and after canning, and during the ripening process, it will be seen from the table that as the pea matures the ash decreases, the starch increases, and the crude fiber decreases as a rule, while the conclusions to be drawn from the determinations of nitrogen and ether extract are less decisive. In the peas from one locality the amount of nitrogen decreased as the pea matured, whereas in the same variety from another locality this variation was not so apparent. Similar changes in composition appear in the canned vegetables. The analyses seem to indicate that during the process of canning the peas take up from 2 to 10 per cent of water. It is difficult from these results to draw any conclusions as to the changes taking place during processing. The principal value of the work, as before stated, is to afford data for the comparison of commercial grades.

It is interesting to note that the crude fiber of peas is usually higher in the young, small grades than in the larger, more mature ones. This is due largely, of course, to the fact that the very smallest of the peas consist largely of water and this outside fibrous coat, the meaty portion having not been developed. This determination is of no value in deciding whether peas have been subjected to the soaking process, since but very little difference appears in the values obtained for fresh and for soaked peas.

The blanks in the analytical table are due, first, to the fact that several of the determinations were discontinued after finding that they led to no conclusive results as to the quality of the goods under examination, and also to the fact that the analytical work was performed at different times. At first it was intended to make a moisture determination only on the drained substance, and about 85 samples of peas were examined accordingly. Later it was found that determinations of specific gravity and starch might also be of value, but as no duplicates of the early samples were obtainable the additional work was done only on the later samples.

Analytical data on fresh and canned peas and Lima beans. a

ANALYSIS OF FRESH PEAS.

No.	Description and appearance.	Weight of veg- etable.	Weight of liquor.	Determinations on drained substance.						Calculated to dry basis.					
				Water.	Crude fiber.	Crude starch.	Nitro- gen.	Specific gravity.	Ash.	Ether extract.	Crude fiber.	Crude starch.	Nitro- gen.	Ash.	Ether extract.
	Hamburg Alaska—	Grams.	Grams.	Per ct.	Per ct.	Per ct.	Per ct.	1.04-1.07	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
1	No. 1.....	79.74	2.23	79.74	2.23	6.61	0.99	1.04-1.07	0.867	0.36	11.01	32.13	4.89	4.28	1.78
2	No. 2.....	75.98	2.40	75.98	2.40	9.73	.91	1.05-1.10	.872	.52	10.00	40.55	3.79	3.63	2.17
3	No. 3.....	70.16	2.71	70.16	2.71	14.77	1.10	1.05-1.12	.896	.51	9.08	49.50	3.69	3.00	1.71
4	No. 4.....	67.79	2.80	67.79	2.80	16.85	1.29	1.07-1.12	1.084	.46	8.69	52.30	4.01	3.37	1.43
5	No. 5.....	66.31	2.88	66.31	2.88	17.47	1.32	1.08-1.12	1.036	.54	8.55	51.86	3.92	3.08	1.60
	Batavia Alaska—														
6	No. 1.....	80.87	1.56	80.87	1.56	6.77	.86	1.04-1.07	.736	.237	8.16	35.39	4.49	3.85	1.24
7	No. 2.....	76.10	1.89	76.10	1.89	10.26	1.03	1.05-1.10	.816	.253	7.91	42.93	4.31	3.41	.975
8	No. 3.....	69.47	2.19	69.47	2.19	15.46	1.25	1.07-1.11	1.01	.337	7.17	50.64	4.09	3.31	1.10
9	No. 4.....	66.68	2.36	66.68	2.36	17.31	1.36	1.06-1.11	1.04	.362	7.08	51.95	4.08	3.12	1.09
10	No. 5.....	64.05	2.31	64.05	2.31	18.30	1.58	1.06-1.12	1.06	.394	6.46	50.9	4.40	2.95	1.10
	Hamburg Admiral—														
11	No. 1.....	82.27	1.66	82.27	1.66	5.69	1.01	1.03-1.07	.891	.189	9.36	32.10	5.7	5.03	1.06
12	No. 2.....	81.04	2.04	81.04	2.04	6.65	.97	1.03-1.07	.833	.289	10.76	35.08	5.12	4.39	1.52
13	No. 3.....	80.10	2.20	80.10	2.20	6.74	.98	1.03-1.07	.839	.366	11.06	33.87	4.92	4.22	1.84
14	No. 4.....	78.73	2.27	78.73	2.27	7.91	.98	1.03-1.08	.848	.504	10.67	37.19	4.61	3.99	2.37
15	No. 5.....	78.71	2.76	78.71	2.76	9.48	1.08	1.03-1.08	.860	.588	12.96	44.55	5.07	4.04	2.76
	Batavia Admiral														
16	No. 1.....	77.75	2.04	77.75	2.04	8.62	1.06	1.03-1.07	.877	.214	9.17	38.74	4.76	3.94	.962
17	No. 2.....	77.70	2.16	77.70	2.16	9.48	.98	1.04-1.07	.783	.173	9.73	42.68	4.41	3.53	.778
18	No. 3.....	76.16	2.29	76.16	2.29	9.82	1.11	1.04-1.07	.806	.170	9.61	41.19	4.66	3.76	.713
19	No. 4.....	76.15	2.26	76.15	2.26	10.12	1.06	1.04-1.08	1.00	.130	9.48	42.43	4.44	2.19	.545
20	No. 5.....	75.17	2.28	75.17	2.28	11.19	1.16	1.03-1.08	.912	.168	9.18	45.07	4.67	3.67	.677

ANALYSIS OF CANNED PEAS.

	Hamburg Alaska—														
21	No. 1	85.30	1.69	85.30	1.69	5.41	1.209	1.02-1.07	1.209		11.50	36.80		8.22	
22	No. 2	81.08	1.99	81.08	1.99	8.35	1.173	1.05-1.10	1.173		10.52	44.13		6.20	
23	No. 3	73.36	2.059	73.36	2.059	11.80	1.585	1.05-1.10	1.585		7.73	44.30		5.95	
24	No. 4	75.82	2.359	75.82	2.359	14.15	1.133	1.07-1.12	1.133		9.76	55.52		4.68	
25	No. 5	73.06	2.423	73.06	2.423	15.45	1.211	1.08-1.14	1.211		9.00	57.35		4.50	

Analytical data on fresh and canned peas and Lima beans—Continued.

ANALYSIS OF CANNED PEAS—Continued.

No.	Description and appearance.	Weight of veg- etable.	Weight of liquor.	Determinations on drained substance.						Calculated to dry basis.					
				Water.	Crude fiber.	Crude starch.	Nitro- gen.	Specific gravity.	Ash.	Ether extract.	Crude fiber.	Crude starch.	Nitro- gen.	Ash.	Ether extract.
		<i>Grams.</i>	<i>Grams.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
62	Indiana Extra Prime Sweet's 1-8 (majority broken, soft, assorted sizes, liquid thick, milky).....	315	247	82.52	1.82	7.32	.....	1.06-1.09	.....	.....	10.39	41.80	.....	.....	.....
63	Indiana Old Sweet's 533 (majority broken, skins pushed off, liquid thick, milky).....	326	242	78.92	2.33	9.40	.....	1.07-1.10	.....	.....	11.04	44.56	.....	.....	.....
64	Indiana Very Old Sweet's 532 (majority hard, skins pushed off, liquid thick, milky).....	356	204	76.99	2.31	10.19	.....	1.07-1.10	.....	.....	10.05	44.33	.....	.....	.....
65	Fancy (mealy, sifted, large peas).....	380	223	78.35	2.22	9.41	.....	1.06-1.12	.....	.....	10.25	43.51	.....	.....	.....
66	Fancy (sifted, sweet, good).....	378	187	86.84	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
67	Fancy (sifted, sweet, good).....	380	197	78.53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
68	Fancy (sifted, sweet, good).....	365	222	78.87	2.14	8.42	.....	.....	.....	.....	10.12	39.83	.....	.....	.....
69	Extra Fancy (sweet, good).....	380	205	87.04	1.88	5.49	.....	1.06-1.08	.....	.....	14.51	42.36	.....	.....	.....
70	Extra Fancy (sweet, good).....	380	190	86.87	1.73	5.27	.....	1.06-1.08	.....	.....	13.18	40.14	.....	.....	.....
71	Extra Fancy (good).....	380	190	86.85	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
72	Tom Thumb (very small, excellent).....	359	210	85.99	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
73	Petit Pois (small).....	334	238	85.99	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
74	Sifted Little Gem (small).....	353	233	85.91	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
75	Telephone (some broken and soft).....	374	218	74.62	2.32	12.15	.....	1.10-1.14	.....	.....	9.14	47.86	.....	.....	.....
76	Telephone (large, firm, not succulent).....	398	194	78.61	2.41	9.13	.....	1.07-1.12	.....	.....	11.27	42.67	.....	.....	.....
77	Telephone (first quality, sifted).....	389	201	82.68	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
78	Telephone (quite soft).....	400	193	81.87	2.63	7.11	.....	1.06-1.08	.....	.....	14.51	39.22	.....	.....	.....
79	Telephone (soft, sifted).....	396	196	82.94	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
80	Early June.....	380	205	79.59	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
81	Early June (good quality).....	383	215	79.59	.....	.....	.....	1.12-1.16	.....	.....	.....	47.52	.....	.....	.....
82	Early June, Extra No. 7 (fair quality).....	305	265	74.55	.....	.....	.....	1.10-1.14	.....	.....	.....	47.66	.....	.....	.....
83	Early June (a little mushy).....	372	232	75.10	.....	.....	.....	1.10-1.16	.....	.....	.....	.....	.....	.....	.....
84	Early June (firm, large, many hard).....	351	232	Lost.	.....	.....	.....	1.08-1.14	.....	.....	.....	.....	.....	.....	.....
85	Early June (medium size, good quality).....	366	229	82.30	7.37	10.55	.....	Below 1.10	.....	.....	.....	41.64	.....	.....	.....
86	Early June (medium size, fair quality).....	335	250	75.45	12.00	6.63	.....	1.08-1.10	.....	.....	.....	48.88	.....	.....	.....
87	Early June (medium size, fair quality).....	378	200	84.04	.....	.....	.....	Below 1.10	.....	.....	.....	41.50	.....	.....	.....
88	Early June (large, mealy, many hard).....	378	200	78.88	.....	.....	.....	1.08-1.12	.....	.....	.....	41.52	.....	.....	.....
89	Early June (large, mealy, many hard).....	386	189	77.89	9.34	7.20	.....	1.08-1.14	.....	.....	.....	32.30	.....	.....	.....
90	Early June (large, mealy, many hard).....	377	299	74.84	.....	.....	.....	1.08-1.14	.....	.....	.....	32.36	.....	.....	.....
91	Early June (large, mealy, many hard).....	294	252	73.21	.....	.....	.....	1.08-1.14	.....	.....	.....	32.30	.....	.....	.....
92	Early June (appear soaked).....	387	208	82.61	2.47	13.95	.....	1.06-1.08	.....	.....	.....	52.07	.....	.....	.....
93	Choice (fairly soft).....	364	224	83.63	1.88	7.08	.....	1.08-1.12	.....	.....	.....	52.07	.....	.....	.....
94	First quality; a few old.....	381	209	79.29	1.95	15.03	.....	1.05-1.08	.....	.....	.....	11.48	43.25	.....	.....
95	Good quality; a few old.....	381	209	79.29	1.95	15.03	.....	1.05-1.08	.....	.....	.....	9.41	43.62	.....	.....

101 Large, firm, about same as No. 30

101	Large, firm, about same as No. 30	197	86.73	2.12	16.19	1.12-1.18	7.24	55.27
102	Soaked, some mushy	356	70.71	1.83	14.05	1.12-1.16	7.26	52.89
103	do	359	73.43	2.24	8.62	1.12-1.16	8.74	33.62
104	do	335	73.67	2.10	13.70	1.06-1.12	5.53	36.12
105	do	324	71.67	2.49	6.87	1.10-1.16	9.93	27.39
106	do	294	74.36	2.24	13.70	1.12-1.16	8.63	53.12
107	do	344	72.07	2.24	13.98	1.12-1.16	8.42	57.13
108	do	353	73.68	2.24	16.62	1.12-1.16	39.35	39.35
109	do	380	71.91	2.45	11.08	1.10-1.16	9.25	69.53
a 110	Soaked, liquor very cloudy	274	71.84	2.42	18.19	1.10-1.16	8.82	51.67
a 111	Soaked, very poor, mushy	280	73.84	2.43	12.83	1.10-1.16	44.64	51.67
a 112	Soaked, liquor very cloudy	401	72.66	2.43	13.54	1.12-1.16	51.50	51.50
a 113	Soaked, sample poor	152	74.06	2.43	14.47	1.12-1.16	58.90	58.90
a 114	Soaked, cloudy, broken and soft	308	71.97	2.43	14.79	1.12-1.16	51.27	51.27
a 115	Soaked, cloudy, broken and soft	390	74.10	2.43	14.31	1.12-1.16	52.36	52.36
a 116	Soaked, cloudy, broken and soft	300	71.15	2.43	15.25	1.12-1.16	54.81	54.81
a 117	Soaked, many broken	341	72.67	2.24	15.04	1.12-1.16	56.08	56.08
a 118	Soaked, very mushy	330	73.05	2.24	15.77	1.12-1.16	54.50	54.50
a 119	Soaked, fairly firm	253	73.05	2.24	15.77	1.12-1.16	54.50	54.50
120	Soaked, some soft, color fair	385	71.00	2.24	15.77	1.12-1.16	54.50	54.50
121	Soaked, many poor	350	71.70	2.24	15.77	1.12-1.16	54.50	54.50
122	Soaked, good, some black	250	71.06	2.24	15.77	1.12-1.16	54.50	54.50
123	Soaked, somewhat mushy	304	73.62	2.24	15.77	1.12-1.16	54.50	54.50

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ANALYSIS OF CANNED LIMA BEANS.

1	A. Brakeley, No. 1	423	77.23	1.64	12.18	1.06-1.10	7.22	53.49
2	A. Brakeley, No. 2	402	72.31	1.92	14.83	1.06-1.12	6.21	53.56
3	A. Brakeley, No. 3	223	71.61	1.91	16.06	1.10-1.14	6.72	56.35
4	Roach, small, sifted, green	387	72.30	1.70	13.30	1.08-1.12	6.88	53.85
5	Roach, little quarter	411	73.00	1.73	13.12	1.08-1.12	7.18	51.30
6	Roach, Pride of Michigan, green	201	73.00	1.62	15.25	1.08-1.14	6.01	56.59
7	Roach, Marcellus	205	73.05	1.71	15.90	1.10-1.14	6.32	58.74
8	Jessup, California fancy, soaked	403	72.93	1.99	15.30	1.10-1.14	7.23	53.50
9	Latmet, soaked	376	72.47	2.09	15.27	1.10-1.14	7.26	53.06
10	Kenwood, soaked	Lost.	71.22	2.03	16.05	1.08-1.10	7.84	62.02
11	Torsch, soaked	Lost.	71.71	2.23	16.27	1.08-1.14	7.88	57.51

a Samples 110 to 119, inclusive, had the following protein content: 6.87, 6.69, 6.56, 6.13, 6.69, 6.44, 6.06, 7.31, 6.63, and 6.19.



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